

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problems Mailbox.**

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 December 2000 (28.12.2000)

PCT

(10) International Publication Number
WO 00/79239 A1

(51) International Patent Classification⁷: G01N 15/00.
F16L 1/11

Halvor [NO/NO]; Kornblomstunet 9, N-4027 Stavanger
(NO).

(21) International Application Number: PCT/NO00/00206

(74) Agents: HÅMSØ, Eivind et al.; Håmsø Patentbyrå, ANS,
Box 171, N-4302 Sandnes (NO).

(22) International Filing Date: 14 June 2000 (14.06.2000)

(81) Designated States (national): AE, AG, AL, AM, AT, AT
(utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH,
CN, CR, CU, CZ, CZ (utility model), DE, DE (utility
model), DK, DK (utility model), DM, DZ, EE, EE (utility
model), ES, FI, FI (utility model), GB, GD, GE, GH, GM,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,
SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US,
UZ, VN, YU, ZA, ZW.

(25) Filing Language: Norwegian

(26) Publication Language: English

(30) Priority Data:
19992950 17 June 1999 (17.06.1999) NO

(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European

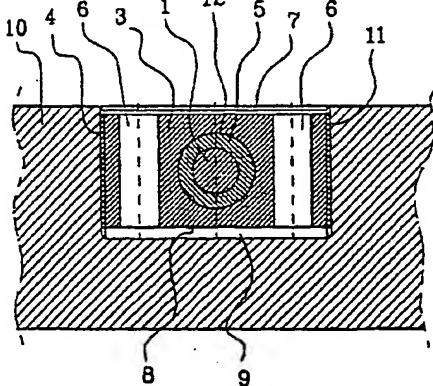
(71) Applicant (for all designated States except US): HITEC
ASA [NO/NO]; Postboks 6181, N-4069 Stavanger (NO).

(72) Inventor; and

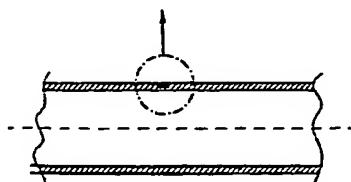
(75) Inventor/Applicant (for US only): HALVORSEN,

[Continued on next page]

(54) Title: DEVICE RELATED TO LABELLING OF TOOLS, EQUIPMENT AND PIPES



(57) Abstract: A device for marking pipes, including tools and equipment incorporated in a pipe string, which is used in a well, particularly in connection with the recovery of hydrocarbons, wherein an electronic tag (1, 2) is placed in a mounting hole (9) of a pipe wall (10), and is protected against the surroundings by means of a magnetic non-conductive material, for example a synthetic material. The electronic tag (1, 2) is arranged in a hole or a recess (5, 14) in a support (3, 13), which is made of a magnetic non-conductive material, and which is arranged to be secured in the mounting hole (9). The support (3, 13) is provided with at least one channel (6), which is arranged to establish fluid communication between the first and exposed end surface (7) of the support (3, 13) and its second end surface (8) at the bottom of the mounting hole (9).



WO 00/79239 A1



patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

- *With international search report*

DEVICE RELATED TO LABELLING OF TOOLS, EQUIPMENT AND PIPES

The invention relates to a device for marking tools, equipment and pipes, which are used in a well, in connection with the recovery of hydrocarbons.

- 5 Equipment, tools and pipes, including drill pipes, which are used in a well, are subject to wear and other loads, which involves that said components need to be overhauled or changed after some time. Therefore, it is desirable to log well depth, pressure, load, torque and other parameters of 10 operations, in which each component has been used.

Equipment and tools for well operations are often positioned by a pipe string, which is made up of several pipes. In order to position equipment and tools at the correct location in the well, a consecutive log is kept, containing the length of 15 the individual pipes, equipment and tools incorporated in the pipe string.

For said logging to be carried out, it is necessary to be able to identify tools and equipment, and not least the

individual pipes being used. This may be done by providing the equipment, tools and pipes with a mark, which can be recognized and is suitable for distinguishing one piece of equipment/a tool/a pipe from another.

- 5 In the following, the term pipe is used for all components incorporated in a pipe string used in a well, including drill pipes, drill collars, reamers, valves, motors and other items.

- 10 It is known to provide pipes with tags which can be read and recognized electronically. The mark consists in an electronic circuit, attached to the pipe, transmitting electromagnetic identifying signals, which can be picked up by an antennae, which is located relatively near the electronic circuit, and can be recognized by a receiver connected to the antennae.
- 15 There are several known solutions for electronic marking, and equipment for detecting and identifying the marks.

- 20 Equipment for detecting and reading a tag may be positioned near a point passed by the tag when a pipe is inserted into or withdrawn from the well. Portable reader equipment is also known, which is arranged to detect and read an electronic tag when the reading equipment is passed close to the tag.

- The pipe surface is exposed to great contact forces against the wall of the well, and considerable wear arises. Electronic tags attached to the pipe surface are easily damaged. Therefore it is common to place an electronic tag countersunk in a mounting hole or groove in the pipe surface, so that the tag itself does not contact the wall of the well.

Known electronic tags must be read through a material which is not magnetically conductive, or which is at least a very poor magnetic conductor. Therefore it is common to place an electronic tag in a mounting hole in the pipe wall and fill 5 the mounting hole with a casting compound, for example epoxy. The tag can be detected and read through an electromagnetic signal transmitted by the tag through the casting compound.

It has turned out to be difficult to achieve an acceptable durability for electronic tags on pipes used in a well. The 10 tags are being mechanically damaged and cease to work, or they come loose and disappear. There are several conceivable causes of the damage to, or disappearance of, electronic tags. One cause may be that the hardening process of the epoxy and other temperate casting compounds go on for a long 15 time after the compound has hardened, and that an elevated temperature in the well may increase the hardening activity. The hardening may lead to dimensional changes and cracking of the casting compound. This itself may destroy an embedded electronic tag, but it may also lead to cracking of the 20 casting compound, so that the tag is exposed to the surrounding medium, typically drilling fluid or well fluid. Damage may occur through chemical influence, or because of the surrounding medium having a pressure higher than what the tag can withstand.

25 Damage observed may suggest that the casting compound may be cracked from inside in some cases. This is assumed to be caused possibly by the casting compound rarely being free of pores, and the surrounding medium at high pressure entering 30 into pores of the casting compound, possibly all the way to the bottom of the mounting hole. When the pipe is later brought to the surface and to a reduced ambient pressure, the

casting compound may be cracked by liquid or gas at high pressure present in pores or in microscopic cracks, in the casting compound or the mounting hole within the casting compound.

- 5 The object of the invention is to provide an improved device for marking tools, equipment and pipes, which are used in a well.

The object is realized through features as stated in the following description and subsequent Claims.

- 10 According to the invention, an electronic tag is mounted in a support which is produced of a non-magnetic conductive material, which is suitable for allowing electromagnetic signals from the tag to pass, and which is resistant to surrounding medium in a well. The support with the electronic tag is placed into a mounting hole in the pipe wall and is secured thereto. Thereby is achieved that the tag is covered and protected by a material which need not be mouldable and temperate, so that problems which may be caused by a never-ending hardening process, are avoided.
- 15
- 20 The tag may with advantage be secured to the support by a substance which does not harden, or which only achieves a limited hardness. Compound used for so-called "locking" of threads is highly suitable. Thereby a damping of vibrations and a reduction of mechanical loads on the tag are achieved.
- 25 The support may with advantage be designed so that the surrounding medium can pass and enter into the mounting hole, i.e. within the support. Thereby, pressure equalization is achieved, so that the support does not collapse by high

external pressure. Passage also prevents gas or liquid, which possibly accumulates in the mounting hole within the support with time, from forcing the support out of the hole, when the pipe is brought into an area of reduced ambient pressure.

- 5 In a preferred embodiment the support forms a short cylinder with external threads for screwing into a threaded mounting hole in the pipe wall. An electronic tag is placed in a hole or a recess in the support and is secured to the support with thread-locking compound or other material which stays
- 10 plastic. The support covers the tag, so that it will not be exposed to mechanical contact with the wall of the well. The support may be provided with a hole or other passage providing fluid communication between the side of the support facing the surrounding medium, and the side facing inwards
- 15 towards the bottom of the mounting hole, in which the support is secured.

The support may be formed in synthetic material, which may be reinforced with fibres, and which is resistant to surrounding medium in the well at the prevailing pressure and

- 20 temperature. Good results have been achieved with a synthetic material with the trade name PEEK.

According to the invention, the bottom of the mounting hole, in which the support is to be mounted, may be provided with a mark fit to identify the pipe independently of the electronic tag. The bottom of the mounting hole may typically be provided with a serial number through mechanical stamping, engraving, laser engraving or in another known manner. Thereby the pipe may be identified by manual inspection if the electronic tag should be destroyed or be lost. After

manual identification a new electronic tag is fitted prior to further use of the pipe.

The invention will be described in further detail in the following by means of two exemplary embodiments, and reference is made to the appended drawings, in which:

Fig. 1 shows in perspective a first known rod-shaped electronic tag;

Fig. 2 shows in perspective a second known disc-shaped electronic tag;

10 Fig. 3 shows in perspective a support for a rod-shaped tag;

Fig. 4 shows, in a sectional side view, the support in Fig. 3 and part of a pipe wall, in which the support is mounted;

Fig. 5 shows in perspective a support for a disc-shaped tag;

15 Fig. 6 shows, in a sectional side view, the support in Fig. 5 and part of a pipe wall, in which the support is mounted.

In Fig. 1 the reference numeral 1 identifies a known rod-shaped electronic tag, which is arranged to be activated by an external, alternating magnetic field, and produce enough energy therefrom for transmitting electromagnetic signals
20 carrying a predetermined code. Each tag is provided with a unique code, and may thereby be distinguished from corresponding or otherwise identical tags. Another known electronic disc-shaped tag 2 is shown in Fig. 2. The tags 1, 2 essentially work in the same way, but the rod-shaped tag 1

manual identification a new electronic tag is fitted prior to further use of the pipe.

The invention will be described in further detail in the following by means of two exemplary embodiments, and reference is made to the appended drawings, in which:

Fig. 1 shows in perspective a first known rod-shaped electronic tag;

Fig. 2 shows in perspective a second known disc-shaped electronic tag;

10 Fig. 3 shows in perspective a support for a rod-shaped tag;

Fig. 4 shows, in a sectional side view, the support in Fig. 3 and part of a pipe wall, in which the support is mounted;

Fig. 5 shows in perspective a support for a disc-shaped tag;

15 Fig. 6 shows, in a sectional side view, the support in Fig. 5 and part of a pipe wall, in which the support is mounted.

In Fig. 1 the reference numeral 1 identifies a known rod-shaped electronic tag, which is arranged to be activated by an external, alternating magnetic field, and produce enough energy therefrom for transmitting electromagnetic signals 20 carrying a predetermined code. Each tag is provided with a unique code, and may thereby be distinguished from corresponding or otherwise identical tags. Another known electronic disc-shaped tag 2 is shown in Fig. 2. The tags 1, 2 essentially work in the same way, but the rod-shaped tag 1

transmits directional electromagnetic signals, and the receiving antennae must therefore be oriented relative to the longitudinal direction of the tag 1.

- The rod-shaped tag 1 has turned out to be advantageous in that it is very robust. By orienting the rod-shaped tag 1 in a predetermined direction relative to the pipe, for example so that the longitudinal axis of the tag 1 is parallel to the longitudinal axis of the pipe, the receiving antennae may easily be oriented correctly.
- 10 A cylindrical support 3 for the rod-shaped tag 1, see Fig. 3, is provided with external threads 4. A transversal circular hole 5 has open ends on two diametrically opposite sides of the support 3. The diameter of the support 3 should be slightly larger than the length of the rod-shaped tag 1, and 15 the diameter of the transversal hole 5 should be slightly larger than the diameter of the rod-shaped tag 1, so that the rod-shaped tag 1 can be placed in the transversal hole 5.

- 20 Two channels 6 are arranged to establish fluid communication between one end surface 7 of the support 3 and the other end surface 8 of the support. The channels 6 are positioned on either side of the transversal hole 5.

In Fig. 4 the support 3 is shown, screwed into a non-through-going, mounting hole 9 in a pipe wall 10, the mounting hole 9 being provided with not shown threads which 25 are complementary to the external threads 4 of the support 3. Before the support 3 is screwed into the mounting hole 9, a securing compound 11 (thread lock) of a known type is applied to the threads 4. The securing compound 11 is arranged to prevent the support 3 from coming loose and being unscrewed

due to vibrations. The securing compound 11 should be of a type, which stays plastic at an elevated temperature, for example at a temperature of more than one hundred and eighty degrees Celsius. Thereby, the support 3 may be unscrewed by 5 preheating of the pipe wall 10 with warm air, so that the securing compound 11 becomes plastic or possibly liquid.

The support 3 may easily be subjected to a torque for screwing by means of a known tool, not shown, provided with two pins, each arranged to engage one of the channels 6.

10 The rod-shaped electronic tag 1 is mounted in the transversal hole 5 of the support 3, and is secured by means of a securing compound 12 before the support 3 is screwed into the mounting hole 9. The securing compound 12 should be of a type, which remains plastic in the relevant conditions of 15 use, so that the securing compound 12 can have a damping effect and protect the tag 1 against vibrations.

As mentioned, the rod-shaped electronic tag 1 should be oriented in a predetermined direction, for example such that the longitudinal axis of the tag 1 is parallel to the 20 longitudinal axis of the pipe that the pipe wall 10 belongs to. The orientation of the tag 1 may easily be determined by rotating the support 3, so that an imaginary line, not shown, between the two channels 6 is oriented in a predetermined direction, for example perpendicular to the longitudinal axis 25 of the pipe. The transversal hole 5 in the support 3 may with advantage be located closer to the end surface 8, which is nearest to the bottom of the mounting hole 9, to have as much as possible of the protective material of the support 3 between the tag 1 and the external mechanical forces.

hole 9 without threads by means of other known securing means, including the means of a lock ring in a groove in the wall of the mounting hole 9, or by means of a suitable glue.

C l a i m s

1. A device for marking pipes, including tools and equipment incorporated in a pipe string, which is used in a well, particularly in connection with the recovery of hydrocarbons, wherein an electronic tag (1, 2) is placed in a mounting hole (9) of a pipe wall (10), and is protected against the surroundings by means of a magnetic non-conductive material, characterized in that the electronic tag (1, 2) is arranged in a hole or a recess (5, 14) in a support (3, 13), which is made of a magnetic non-conductive material, and which is made of magnetic non-conductive material, and which is arranged to be secured in the mounting hole (9).
5
10
2. A device according to claim 1, characterized in that the support (3, 13) is provided with external threads (4), and that the mounting hole (9) is provided with internal complementary threads, whereby the support (3, 13) is arranged to be screwed into the mounting hole (9).
15
3. A device according to claim 1 or 2, characterized in that the support (3, 13) is provided with at least one channel (6), which is arranged to establish fluid communication between the first and exposed end surface (7) of the support (3, 13) and its second end surface (8) at the bottom of the mounting hole (9).
20
25
4. A device according to claim 1, 2 or 3, characterized in that the electronic tag (1, 2) is secured in the transversal hole (5) or recess (14) of the

1/5

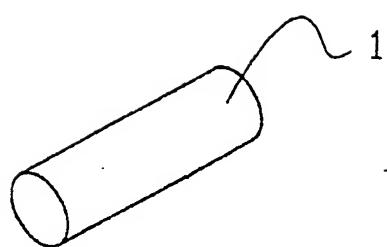


FIG. 1

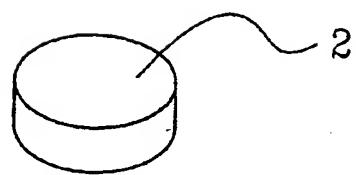


FIG. 2

2/5

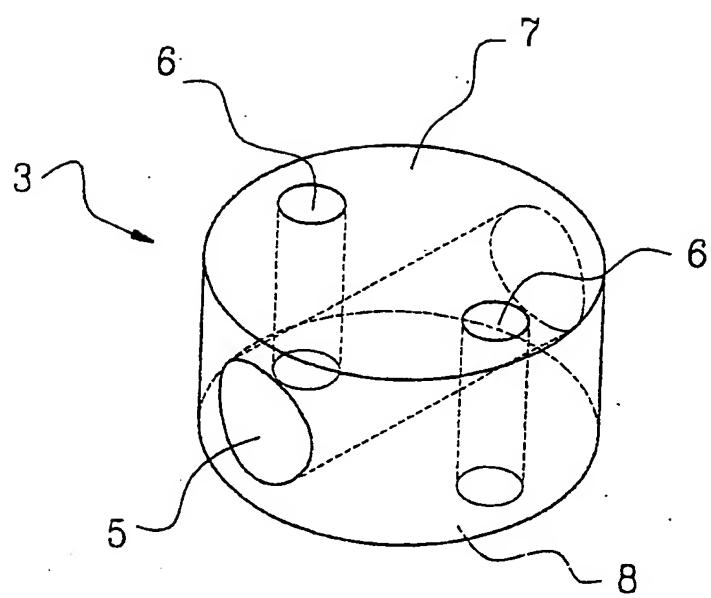


FIG. 3

3/5

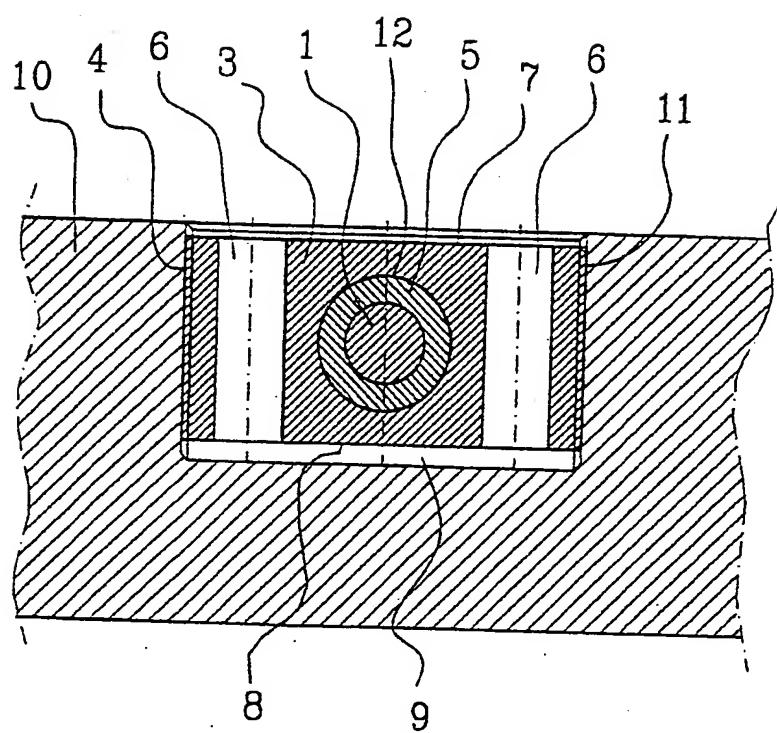
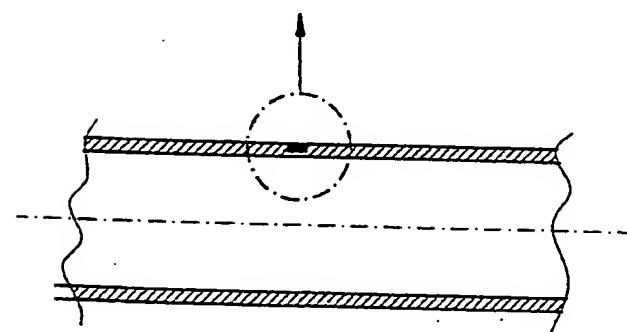


FIG. 4



4/5

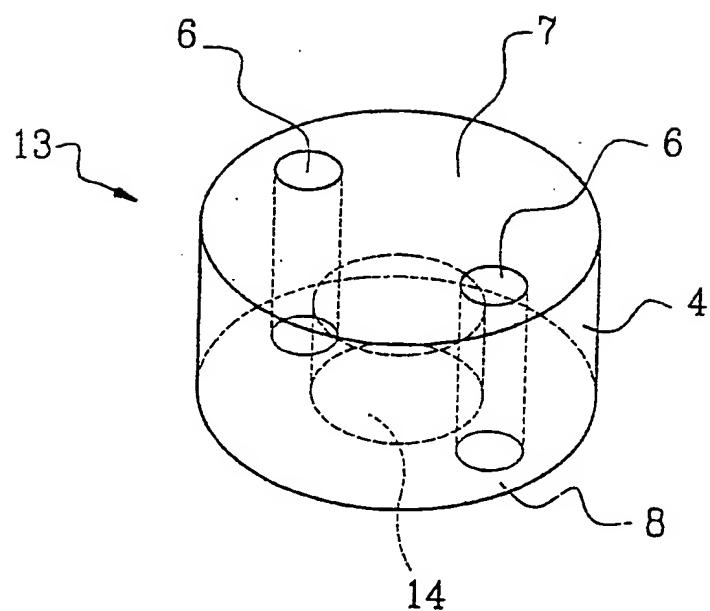


FIG. 5

5/5

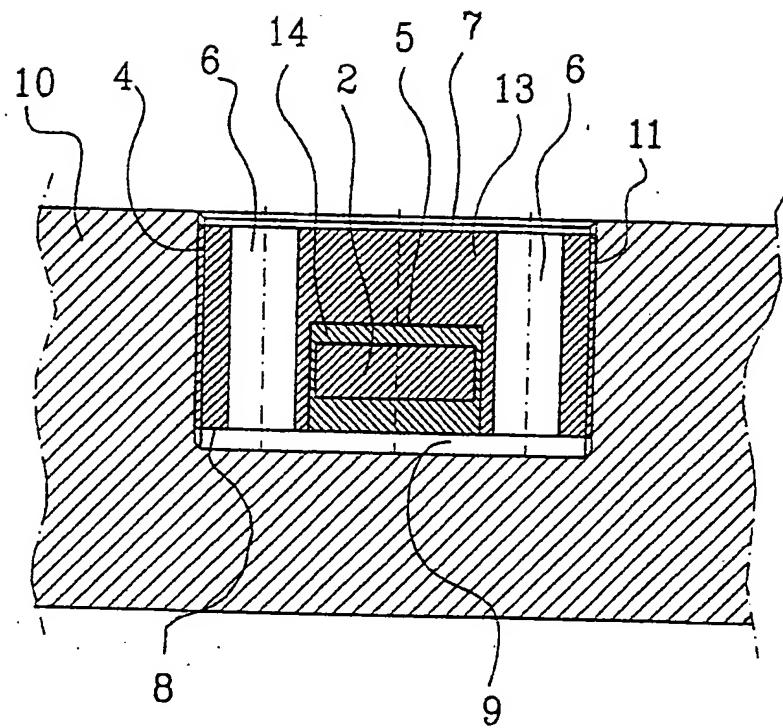
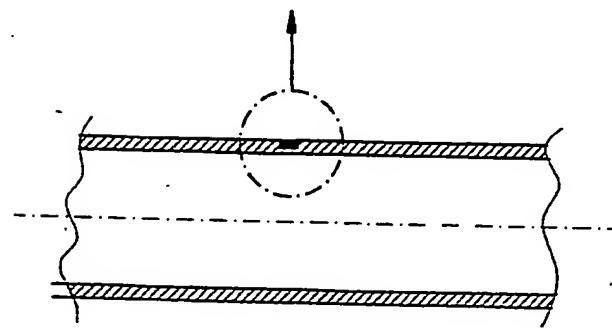


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 00/00206

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01N 15/00, F16L 1/11

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01N, F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0408320 A2 (DU PONT LIMITED), 16 January 1991 (16.01.91), column 1, line 18 - line 34, figure 1, abstract	1,4
A	abstract	2-3,5
A	--	
A	US 5532598 A (WILLIAM G. CLARK, JR. ET AL), 2 July 1996 (02.07.96), abstract	1-5
A	--	
A	FR 2164467 (VIAZZI PIERRE), 3 August 1973 (03.08.73), claims 1-4	1-5
	--	

Further documents are listed in the continuation of Box C.

See patent family annex.

- * Special categories of cited documents
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search 25 Sept 2000	Date of mailing of the international search report 28-09-2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Mats Raidla/MN Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.

PCT/NO 00/00206

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP	0408320	A2 16/01/91	AT 106146 T DE 69009113 D,T GB 8915853 D	15/06/94 03/11/94 00/00/00
US	5532598	A 02/07/96	CA 2190737 A CN 1151212 A DE 69516138 D EP 0760959 A,B JP 10501332 T WO 9532439 A	30/11/95 04/06/97 00/00/00 12/03/97 03/02/98 30/11/95
FR	2164467	03/08/73	NONE	